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Original Article

Video-assisted thoracoscopic surgical decortication in the elderly with thoracic empyema: Five years' experience

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Abstract

Background: Video-assisted thoracoscopic surgery (VATS) with decortication is a major treatment for thoracic empyema in the fibropurulent stage. Compared to open thoracotomy, VATS decortication has similar efficacy but fewer postoperative complications in the treatment of thoracic empyema. The role of VATS decortication in the elderly had rarely been investigated.
Methods: From January 2006 to August 2011, we retrospectively enrolled 33 patients older than 65 years diagnosed as thoracic empyema and treated with VATS decortication. We analyzed the outcomes of this geriatric population, including surgical effectiveness, postoperative morbidity, and mortality.
Results: A total of 33 patients with mean age of 73.6 ± 7.1 years received VATS decortication for their empyema. Twenty-one (63.6%) patients were male. Only one patient died of progressive sepsis, due to pulmonary infection 9 days after VATS decortication. The 30-day mortality was 3% after the surgery. The major etiology (87.9%) of thoracic empyema was pneumonia. The main causes of postoperation morbidity included respiratory failure requiring mechanical ventilation for >7 days (15.2%) and septic shock (15.2%), followed by persistent air leakage for >7 days (9.1%). Twenty-four (75%) of 32 patients had good re-expansion of the affected lung 3 months after VATS decortication.
Conclusion: We concluded that VATS decortication in the treatment of thoracic empyema is effective in elderly patients. The major concerns of postoperative complications are respiratory failure and sepsis.

Keywords: elderly; thoracic empyema; video-assisted thoracoscopic decortication

1. Introduction

Pleural effusion develops in 40% of pneumonia patients, but only 15% of patients develop thoracic empyema after antibiotic treatment.[1] Many studies have revealed increasing case numbers of empyema in elderly patients.[2,3] There are three stages of empyema, exudative (Stage I), fibropurulent (Stage II), and organizational (Stage III), which present a continuous course of inflammatory process and should be managed by different medical interventions.[4] The exudative stage can usually be handled with tube drainage and appropriate antibiotic treatment, and seldom needed surgical intervention.[5] The second fibropurulent or third organizational stage often needed tube thoracotomy or surgical decortication because of fibrin

Conflicts of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

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depositions with pleural peels.[5] The mortality of thoracic empyema was 10–20%.[6–8] The treatment of empyema needs adequate antibiotic use and drainage by tube thoracotomy or surgical intervention according to the particular empyema stage and the patient's condition.[6–8] Recently, an increasing number of studies have favored the approach of video-assisted thoracoscopic (VATS) decortication in thoracic empyema treatment.[9–12] One study displayed VATS decortication with a higher successful treatment rate (91% vs. 44%) and shorter hospital stay (8.7 days vs. 12.8 days) compared with the group with tube thoracotomy alone.[13] A meta-analysis,[14] which reviewed 14 large studies, showed VATS decortication had shorter total hospital stay (15 days vs. 21 days, $p = 0.03$) and fewer postoperation complications, such as atelectasis ($p = 0.006$) and mortality ($p = 0.02$), when compared with open decortication. However, the role of VATS decortication in the older population had been rarely reported. Considering the worldwide trend of aging population society in the near future, the best strategy to treat aging and fragile patients with thoracic empyema should be further investigated. Therefore, this study analyzed the outcome and complications of thoracic empyema in older patients treated by VATS decortication in our hospital.

2. Methods

2.1. Study population

This was a retrospective study in National Yang-Ming University Hospital, Yilan City, Taiwan, a 400-bed regional teaching hospital that offers clinical services. From January 2006 to August 2011, we collected those patients with thoracic empyema and treated with VATS decortication. The patient inclusion criteria were (1) older than 65 years; (2) a patient of thoracic empyema; and (3) accepted VATS decortication. Exclusion criteria included patients under long-term ventilator support and patients with septic shock and cardiopulmonary distress. Pleural fluid was obtained by tube thoracotomy or thoracentesis. The definition of empyema was satisfying at least one of the following criteria: (1) pus-like material in the pleural cavity; (2) a positive report of Gram stain or pleural effusion culture for the microorganisms; and (3) pleural effusion analysis with pH $\leq$ 7.2, glucose level $\leq$ 40 mg/dL, and lactic dehydrogenase (LDH) level $\geq$ 1000 U/L.[15] We reviewed the demographic data, comorbidities, clinical symptoms, images, and laboratory data, including pleural fluid and culture report, for evaluation of the morbidity and mortality. The study was approved by the authors' institutional review board (IRB No. 2010A015).

2.2. Surgical technique

We performed VATS decortication with general anesthesia using double-lumen endotracheal tube insertion. After skin preparation and sterilization, two incisions over the lesion site with a 1-cm-length wound in the crossing of the eighth intercostal space and the midaxillary line for camera, and another 3-cm-length wound in the anteriorly fifth intercostal space for access. Also, the two incision wounds allowed surgical instruments to deal with the empyema.[14,16] The decortication was performed using forceps and scissors by a well-experienced chest surgeon.[14]

2.3. Statistical analysis

Statistical analyses were performed using SPSS software version 15.0 (SPSS, Inc., Chicago, IL, USA). The patient data were described by frequency for categorical variables, and by mean ± standard deviation for numeric variables.

3. Results

3.1. Patient characteristics

In total, 33 patients older than 65 years accepted VATS decortications for thoracic empyema. The characteristics of the 33 patients are listed in Table 1. The mean age was 73.6 ± 7.1 years. Twenty-one (63.6%) patients were male. The preoperative comorbidities of the 33 patients were presented with the Charlson comorbidity index. Twenty-four (72.7%) of the empyema patients were categorized as being in the fibropurulent stage, five (15.2%) were in the exudative stage, and four (12.1%) were in the organizational stage.[4] The laboratory data showed a mean white blood cell count of 16.1 ± 8.9 × 10^9/L, and mean C reactive protein of 21.5 ± 11.1 mg/dL. The most common symptoms were cough (78.8%), followed by fever (72.67%; Table 2). The major etiology of thoracic empyema was pneumonia (87.9%; Table 2).

3.2. Pleural effusion analysis

In thoracic empyema, we found 14/31 (45.2%) patients with positive Gram stain or culture of pleural effusion (Table 3). All enrolled patients received antibiotic treatment before VATS because of the clinical presentation of fever, cough, and lung opacities by chest images during the initial hospitalization. The most common pathogens were *Klebsiella pneumonia*

Table 1
Demographic data of patients.

	Cases (%), $n = 33$
Age (y)	73.6 ± 7.1 (65–87)
Male sex	21 (63.6)
Charlson Comorbidity Index	
0	2 (6.0)
1	10 (30.3)
2	6 (18.1)
3	7 (21.2)
4	5 (15.2)
5	2 (6.0)
6	1 (3.0)
Stage of thoracic empyema	
Exudative (Stage I)	5 (15.2)
Fibropurulent (Stage II)	24 (72.7)
Organizational (Stage III)	4 (12.1)

Values are presented as n (%) or mean ± standard deviation (range).

Table 2
Clinical presentation and etiology of thoracic empyema.

	Cases (%), $n = 33$
Clinical presentation	
Fever	24 (72.7)
Cough	26 (78.8)
Dyspnea	21 (63.6)
Chest pain	17 (51.5)
Etiology for thoracic empyema	
Post pneumonia	29 (87.9)
Trauma	2 (6.1)
Tuberculosis	2 (6.1)
Coexisting lung abscess	11 (33.3)

Values are presented as *n* (%).

(3 patients), *Streptococcus* spp. (3 patients), and *Acinetobacter baumannii* (3 patients).

In pleural effusion laboratory analysis (Table 4), the mean white blood cell count was 13.5 ± 19.7 × 10^9/L, mean LDH of 2951 ± 4380 U/L, and mean glucose level of 51.2 ± 53.6 mg/dL.

3.3. Radiologic analysis

The postoperative chest plain radiographs and computed tomography images were reviewed by radiologists and pulmonologists in comparison with the preoperative images. The final decisions on staging of empyema before surgery, disease improvement or progression on discharge, and partial or good expansion of the affected lung 90 days after discharge were determined by consensus.[17]

3.4. Postoperative morbidity and mortality

The mean hospital stay was 27.5 ± 14.5 days. Only one patient died of progressive sepsis, due to pulmonary infection 9 days after VATS decortication. The 30-day mortality was 3% after the surgery. Two patients (6.2%) had recurrent or persistent empyema, and we performed mini-thoracotomy on them 3 months later. The main postoperative morbidities included respiratory failure requiring mechanical ventilation for >7 days (15.2%) and septic shock (15.2%), followed by persistent air leakage for >7 days (9.1%; Table 5). Twenty-seven (84.4%) of 32 patients were stable on discharge, and

Table 3
Microbiological data of thoracic empyema.

	Cases (%), $n = 31$
Gram-stain or culture (+) from pleural effusion	14 (45.2)
Pathogen isolated from pleural effusion	
Klebsiella pneumoniae	3 (9.7)
Streptococcus spp.	3 (9.7)
Acinetobacter baumannii	3 (9.7)
Staphylococcus aureus	2 (6.5)
Pseudomonas aeruginosa	1 (3.2)
Serratia spp.	1 (3.2)
Escherichia coli	1 (3.2)

Values are presented as *n* (%).

Table 4
Pleural fluid laboratory analysis.

	Cases
Leukocyte count (× 10^9/L)	13.5 ± 19.7 ($n = 24$)
Protein (g/dL)	4.2 ± 1.2 ($n = 22$)
LDH (U/L)	2951 ± 4380 ($n = 24$)
Glucose (g/dL)	51.2 ± 53.6 ($n = 20$)

Values are presented as mean ± standard deviation.
LDH = lactic dehydrogenase.

24 (75%) of these patients had good expansion of the affected lung 3 months after VATS decortication.

4. Discussion

In our study, we found that in aged patients (older than 65 years) with thoracic empyema, VATS decortication is an effective treatment. The most common complications after VATS decortication were respiratory failure and sepsis.

Older people usually have atypical presentation of thoracic empyema, with less chest pain and fever but more dyspnea than younger patients, which makes empyema early diagnosis difficult.[18] Due to age-related physiologic function decline and comorbidities, older patients often have higher mortality rate with thoracic empyema.[2] Mandal et al[19] reported that the mortality rate is 50% in patients older than 65 years, compared with patients younger than 65 years (only 3.6% mortality). The older patients in the current study were classified as moderate (Category 3) or high (Category 4) risk for a poor outcome according to American College of Chest Physicians (ACCP) guideline,[20] but we had a lower post-VATS mortality rate and acceptable morbidities. A study in Taiwan in 2005 revealed that the overall 100-day-in-hospital mortality for thoracic empyema in older patients (>65 years) was 13% and only 8% in younger patients.[17] The empyema mortality of older patients seems to have improved in recent decades,

Table 5
Postoperative complications and recovery evaluation.

	Cases (%), $n = 33$
Hospital length of stay (d)	27.5 ± 14.5
Postoperative length of stay (d)	17.9 ± 11.1
Tube drainage duration (d)	15.6 ± 20.4
Postoperative complications	
Mechanical ventilation (d)	7.2 ± 8.2
Respiratory failure	13 (39.4%)
Need for tracheostomy	5 (15.2%)
Septic shock	5 (15.2%)
Persistent air-leak >7 d	3 (9.1%)
Postoperative condition on discharge ($n = 32$)	
Disease remission	3 (9.4%)
Disease stable	27 (84.4%)
Disease progression	2 (6.2%)
Re-expansion of affected lung	
On discharge Day 90 ($n = 32$)	
Good expansion	24 (75.0%)
Partial expansion	4 (12.5%)
Lost to follow-up	4 (12.5%)

Values are presented as *n* (%) or mean ± standard deviation.

which may be related to diagnostic tools, surgical techniques, and health care improvements.[18,21]

VATS decortication uses less operation time and fewer hospital days compared with open decortication.[5,12] One large series of thoracic decortications comparing VATS and open procedures for 420 patients revealed the operation time in VATS decortication was 97 minutes, while in open decortication it was 155 minutes ($p < 0.001$).[5] The median postoperative stay was shorter for VATS decortication patients compared with open decortication patients (7 days vs. 10 days, $p < 0.001$). In addition, there were fewer postoperative complications, such as atelectasis and reintubation in the VATS decortication group.[5,14] In our study, the mean hospital stay was longer (27.5 days) than previous reports,[5,12] as the patients were older in our study (73.6 years vs. 55 years). However, the 30-day mortality was only 3% in our study, which was similar with previous studies.[19] Eleven cases (33%) were diagnosed with coexisting lung abscess in our study. Under the minimally invasive principle, we did not perform unroofing or pulmonary resection. We used adequate chest tube position in addition to the self-ruptured abscess opening in the pleural cavity instead of extensive eradication of the abscess.

There were some limitations to the current study. This was a retrospective study with a relatively small sample size. However, we focused on the elderly group receiving VATS decortication, which has been less discussed previously. We still require a larger case number of older patients receiving VATS decortication to establish a guideline for thoracic empyema treatment in the future.

In conclusion, we think that VATS decortication in the treatment of thoracic empyema is effective in elderly patients.

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